

FIVE TYPHOONS IN THE FAR EAST IN JUNE, 1923.

By Rev. JOSÉ CORONAS, S. J.

[Weather Bureau, Manila, P. I.]

The month of June has been very stormy in the Far East. No less than five typhoons have been noticed in our weather maps, two of them having been particularly severe and destructive in Yap (Western Carolines) and the Philippines, respectively.

The Samar and Leyte typhoon, June 3.—This typhoon was clearly shown by our weather maps in the afternoon of June 2 about 100 miles to the east of the southernmost part of Samar. Proper and timely warnings were sent immediately to the threatened regions of Samar and the northern part of Leyte. The center reached Samar close to Borongan (125° 26' long. E., 11° 37' lat. N.) shortly after midnight of June 2 to 3, barometric minimum registered there being as low as 729.52 mm. (28.72 inches). The typhoon inclined northward after crossing the southern part of Samar, moving NW. between Samar and Masbate. Once in southeastern Luzon, it traversed the Province of Camarines in a northerly direction, thus entering again the Pacific on the morning of June 4. In the Pacific it recurved further northeastward to the east of northern Luzon. We could not follow the typhoon after the 6th, and it is supposed that it filled up not far from 130° longitude E., and 20° latitude N. Very great damage was done to the Provinces of Samar and Leyte, but not so much to Masbate, Albay, and Camarines Provinces, as the typhoon seems to have decreased in intensity after crossing Samar. The town of Borongan in the eastern coast of Samar has been reported as practically swept by the winds, the sea waves, and the rain water rushing from the mountains.

The position of the center on the 2d to 6th was as follows:

June 2, 2 p. m., 127° 00' long. E., 10° 55' lat. N.
 June 3, 6 a. m., 125° 00' long. E., 11° 35' lat. N.
 June 3, 2 p. m., 124° 05' long. E., 12° 05' lat. N.
 June 4, 6 a. m., 122° 50' long. E., 13° 45' lat. N.
 June 5, 6 a. m., 124° 00' long. E., 17° 30' lat. N.
 June 6, 6 a. m., 127° 15' long. E., 19° 55' lat. N.

The Yap typhoon, June 2, 1923.—At 2 p. m. of June 2, while our weather map showed a typhoon to the east of Samar, another one was shown to the SSE. of Yap, Western Carolines, in about 139° long. E., 8° lat. N. As it moved NNW. it passed practically over our

station of Yap nearly before midnight of June 2, only two hours before the preceding typhoon reached the eastern coast of Samar, as stated above. The barometric minimum recorded at Yap was 737.82 mm. (29.05 inches) at 11:35 p. m., and the wind shifted from NW. to S., blowing with hurricane force for about five hours, and causing considerable damage to the Island. There were about two hours of relative calm from 10 p. m. to 12 midnight.

The typhoon was probably situated at 6 a. m. of the 3d and 4th at 122° 25' long. E., 10° 40' lat. N., and 124° 30' long. E., 14° 30' lat. N., respectively. Our weather maps did not show this typhoon any more after the 4th.

Two typhoons east of the Philippines, June 12 to 22.—The first of these typhoons appeared on the 12th to the SSE. of Guam between 145° and 149° longitude E., and in about 6° latitude N. It moved first westward, passing to the S. of Yap in the evening or night of the 13th; then it recurved N. and NE. on the 14th and 15th. The observations from Guam and Yap situated the center on the 16th in about 136° long. E., and 16° lat. N. It was impossible to follow it after the 16th.

The other typhoon was shown by our weather maps about 200 miles to the east of Samar, in the afternoon of the 16th. It moved NNW. on the 16th, N. on the 17th, NW. on the 18th, and N. again on the 19th and part of the 20th, when it passed close to the Meiacoshima group of Islands to the east of northern Formosa. On the 20th it inclined westward and reached the China coast between Shanghai and Formosa.

Typhoon in northern Luzon, June 29.—This typhoon appeared clearly on the 27th over 300 miles to the east of southern Luzon. It moved in a west-northwesterly direction and traversed the northern part of Luzon on June 29. Although the center passed over 100 miles to the north of Manila, strong winds and squalls caused some damage in the City. Considerable damage was done to the roads of Luzon north of Manila. The force of the winds near the center, however, was not much greater than in Manila. The typhoon inclined northward to the south of Hongkong and entered China a few miles to the west of Macao, where considerable damage was done according to cablegrams received in Manila on July 4.

DETAILS OF THE WEATHER IN THE UNITED STATES.

GENERAL CONDITIONS.

ALFRED J. HENRY.

The current weather was exceptional in at least two respects, first, the rather long-continued spell of warm weather in the Middle Atlantic States, and thence northwest to the Lake region and Canada (see Chart III), and second, the heavy rains in the Arkansas River Valley in southern Kansas (see p. 329 of this REVIEW). In connection with the high temperatures in north-eastern districts pilot-balloon observations during the continuance of the high temperatures seem to show an anticyclonic circulation at and above the 1-kilometer level; that is southerly winds over the Plains States, shifting to southwest over the Lake region and becoming north-west over the Middle Atlantic States. See also "Free Air Summary" p. 323 this REVIEW.

The usual details follow.

CYCLONES AND ANTICYCLONES.

By W. P. DAY.

Thirteen low-pressure areas were charted during June, the majority of which took shape over the Plateau and Rocky Mountain regions, where the air pressure is normally low at this season of the year. This persistent low pressure, especially in the far Southwest, in conjunction with the northward movement of the high-pressure belt over the ocean, is coincident with the cessation of the so-called South Pacific HIGHS, that is, high-pressure areas moving in from the Pacific in latitudes south of about 42°. In fact, this type is rarely noted between April and October, probably never in summer. It is also interesting to note that during practically the same period, few if any cyclonic storms pass inland from the Pacific south of latitude 50° with the possible exception of tropical disturbances on the coast of Lower

California. This becomes reasonable when one considers the great difference in normal pressure existing between the Pacific Ocean off California and the interior of California and the lower Colorado valley. All the minor disturbances of the summer months are lost on the slope of this great baric gradient.

Seven high-pressure areas were charted, three of the so-called North Pacific type and two each of the Alberta and Hudson Bay types.

FREE-AIR SUMMARY.

By L. T. SAMUELS, Meteorologist.

A noticeable feature of the mean free-air temperatures for the month was the difference in their variation from the normal over the various sections of the country. (See Table 1.) This characteristic was also pronounced at the surface as is shown by the Climatological Chart III. At most stations the departures did not change appreciably with increasing altitude. At Drexel, however, a consistent change from negative to positive occurred, becoming greatest at the highest level. This relation conforms closely with the increasing southerly component in the resultant wind found at that station from the surface to the highest altitude. (See Table 2.) During the heat waves which prevailed in the latter half of the month it was found that the free-air temperatures were, as a rule, proportionally high with respect to their normals, and in practically every case deep southerly winds prevailed from the surface to the highest levels.

Relative humidities averaged mostly in excess of their normals but the departures were practically all less than 10 per cent except in the highest levels where the observations are as yet too deficient in number to obtain reliable normals. The vapor pressures also averaged mostly above their normals for all stations except Ellendale.

In Table 2 are shown the resultant wind velocities and directions for the month and their normals. At Ellendale, Drexel, and Due West the southerly component exceeded the normal amount as did the resultant velocities at these stations. At the other stations, however, there was but little difference between the means and the normals.

At this season of the year, owing in part to the increase in the number of daylight hours in the higher latitudes, the horizontal temperature gradient from the equatorial to the polar regions becomes decidedly smaller than exists in winter. This condition results in an abatement of the strong upper winds characteristic of the latter season and instead these winds frequently continue extremely light to great heights. In fact, easterly winds are often then found to extend to the stratosphere. In general these conditions occur most frequently at the southern stations as is found this month. As an illustration of an exceptionally light wind extending from the surface to 9,000 meters above, the pilot-balloon observation of the 22d from Royal Center is cited. This velocity varied from practically calm to 3 m. p. s. but never exceeded this amount even to this height. At Broken Arrow on the same day the balloon was followed with two theodolites to a height of 9,600 meters and from that altitude by one theodolite to 20,300 meters. The wind was south from the surface to 10,000 meters where a shift

to west and northwest occurred, remaining so to 15,000 meters, above which it backed steadily becoming south-east at the highest altitude. The velocity at the surface was 9 m. p. s. decreasing to practically calm at 10,000 meters where the shift occurred, then increasing sharply to 16 m. p. s. at 12,000 meters, above which it averaged about 10 m. p. s.

An unusually high two-theodolite observation was obtained at Groesbeck on the 6th when the balloon was followed for 67 minutes reaching a height of 13,000 meters. Strong winds of 30 m. p. s. from the northwest were found at this high altitude.

The morning kite flight at Broken Arrow on the 6th was completed just as a thunderstorm broke at that station. The storm lasted about one hour and a second kite flight was made immediately after the rain stopped. Both flights attained slightly more than 3,500 meters' altitude and are, therefore, of special interest since they show the free-air conditions just preceding and following a typical convection thunderstorm. The general wind drift at the surface was from the south but during the storm this changed to northerly becoming southerly again immediately after the storm. The temperature lapse-rate off the surface during the morning nearly equalled the adiabatic rate for dry air, indicating conditions favorable for convection and supporting thunderstorm development. The winds above 1,000 meters had a greater west component after the storm than they had before and were of a slightly higher velocity. The other elements such as temperature, relative humidity and vapor pressure resumed practically their former state. There was discernible, however, in the second flight a consistently higher temperature to 2,500 meters and a correspondingly lower relative humidity. The small change in the free-air conditions would be expected, since the thunderstorm, originating in some other locality, was merely carried over Broken Arrow by the upper wind and once having passed, the elements would quickly resume their former state.

The following pertinent note by the official in charge of the Drexel station relative to a series of kite flights made on the 20th and 21st is of interest in connection with flights made during thunderstorm conditions:

The weather was generally cloudy and at times threatening during the daylight hours and for the most part clear in the night. Lines of showers passed the station at intervals to the east and the west moving from south to north. Eventually light showers passed over the station during the last flight, thunder began immediately after the flight, and a light drizzling rain set in a few hours later. The showers evidently were the development of clouds of a convectional nature as a characteristic of the weather throughout the week has been cloudy and threatening weather by day and generally clear weather at night.

A decidedly large lapse rate as well as generally high humidity was apparent throughout the entire series. The general wind direction during the series remained mostly south from the surface to the highest levels reached (3,500 meters). The velocities aloft showed an appreciable increase as the series progressed. The temperature above the surface showed practically no change during the series and the moisture content varied with the changes in cloudiness.

The following from Broken Arrow appearing on the kite flight of the 6th is of interest:

Large oil fire at West Tulsa; smoke topped by cumulus cloud. Fire started by thunderstorm during morning.